Project Title: The Marble Roll

The following is our "Cliff Note" version of the full project, meant to provide you with a quick overview of its main features and the standards and content it covers. The complete project specs and related resources are available at this website:

http://scithon.terc.edu/MarbleRoll2000/

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Grade Level: 4–9

Time Frame: Total of 10-12 hours for best results

The project can be shortened. Site provides tips on efficient use of time and extension activities for further investigation.

Description of Project:

The Marble Roll is one of several very good Online Science-athon projects that involve students in engaging activities to discover science in everyday life. In all these projects, students make predictions, collect data, and send their data to a central website. They use hand-drawn and computer-generated graphs and other displays to analyze their own data and those of other participating classes.

The Task:

How far can you roll a marble using a ramp 61 cm long?

Steps in the Process: First, students work in collaborative groups to try to maximize their marble rolls by varying the material used for the ramp and for the flat surface, They experiment with side or center guides, smoothing surfaces, changing the angle of the ramp, altering its shape, modifying the place where the ramp and ground meet, trying different ramp lengths or widths, and releasing the marble from different spots on the ramp. Second, on Marble Roll Day, they collect and record data--first on a printout from the website and then each group entering one line of data in an interactive table on the website. They submit their data and can then use tools on the website to generate displays that help them analyze their class results. Finally, they examine the data from other classes and from all the classes together as they formulate explanations and check their explanations against scientific knowledge and the explanations and experiences of others.

Big Ideas/Essential Learnings:

The Marble Roll project will enliven study of Energy, Motion, Friction, and Simple Machines.

Students who complete this project will gain understanding of the following:

Energy

1. Energy is a property (characteristic) of many things.

2. Kinetic energy is energy associated with motion. Moving air, water, people, vehicles, and marbles all have kinetic energy.

Motion

1. Change and motion go hand in hand. Practically all of the changes we see in the world about us are the result of motion. Change from day to night results from the earth rotating on its axis, change from a calm day to one that is windy results from moving air, and the change of a marble's location results from the marble rolling down the ramp and across a floor.

2. A force (push or pull) changes or controls motion. Pushing moves a stalled car, a running engine propels an emergency vehicle, applying brakes slows or stops a moving school bus, and releasing a marble from a ramp rolls it down the ramp.

Friction

1. Friction is a force that interferes with the movement of one object rolling or sliding over another. It pushes in the direction opposite to which the object is moving.

2. Friction has many causes. One important cause is the roughness of the rolling or sliding surface. Rough surfaces have tiny projecting irregularities. These interlock as one surface rolls or slides over another and resists motion. Smoothing the surfaces can reduce friction.

The website also includes explanations for students and teachers who want to know more about energy, motion, and friction.

Assessment:

The website suggests several strategies for ongoing assessment during the project:

\* Have students keep design folders with sketches, pages from web sites, notes, and measurement records.

\* Ask students to pick two entries and tell you why they selected each entry and explain what it shows.

\* Observe students as they design and test their ramps. Listen to their comments and questions and use them to engage students in conversations about what they are doing and discovering.

\* On Marble Roll Day, have students put their ramps in a long line starting with the ramp that resulted in the marble rolling the greatest distance. Then discuss as a class which ramps worked the best and why.

For assessment at the end of the project, clear, simple rubrics are included for:

\* students’ science research reports

\* students’ oral reports

\* a language arts extension, creating "Challenge Word Lists" and writing reflections using technical vocabulary

In addition, the following rubrics may be helpful in evaluating student learning:

\* Oral Presentation Rubric (from Quest for Liberty WebQuest)

\* Self-Evaluation Rubric (Region 20)

\* The Rubric Bank (Chicago Public Schools)

Technology Used/Skills Required:

\* one or more computers with Internet access and a browser (Netscape 4.0 or an equivalent) and set up for printing

\* an LCD or other projector for class discussion is recommended if only one computer is available.

\* Supplies: a glass marble (standard size, about 8-10 mm in diameter); strips of wood, metal, plastic, cardboard, and similar materials 61 cm (24 inches) long, with various widths and textures to use as ramps; paper, aluminum foil, cloth, paint, cardboard, and similar materials for modifying the ramp surface; a meter stick or metric tape measure to measure the distance the marble rolls.

\* Setting: a large, flat, smooth rolling surface such as a long hall, gym, cafeteria, or meeting room floor, or a paved outside area; Note: If students measure in inches and feet, they can use the online converter on the data-entry page to change the measurements to centimeters.

\* a camera and film to take pictures on Marble Roll Day (optional)

\* Basic computer skills, including ability in Netscape (or other browser) navigation.